

VIDEO A-D/D-A CONVERTER

PART 2: A 30-MHz VIDEO ADC/DAC DEVELOPMENT BOARD

Following last month's introduction into the basic operation of the two main integrated circuits in the design, the TDA8708 and the TDA8702, this second and last instalment focuses on the more practical side of things. Are you triggered? Here is a high-speed video A-D/D-A converter board aimed at helping you on the way with your own video experiments.

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Continued from the May 1991 issue

The block diagram of the development board, Fig. 8, shows the two converter ICs surrounded by quite a few sockets, switches and connectors. The switches, K₁ through K₉, are actually jumpers that allow different modes of operation to be selected. The BNC sockets, K₁₀ through K₁₇, are the analogue

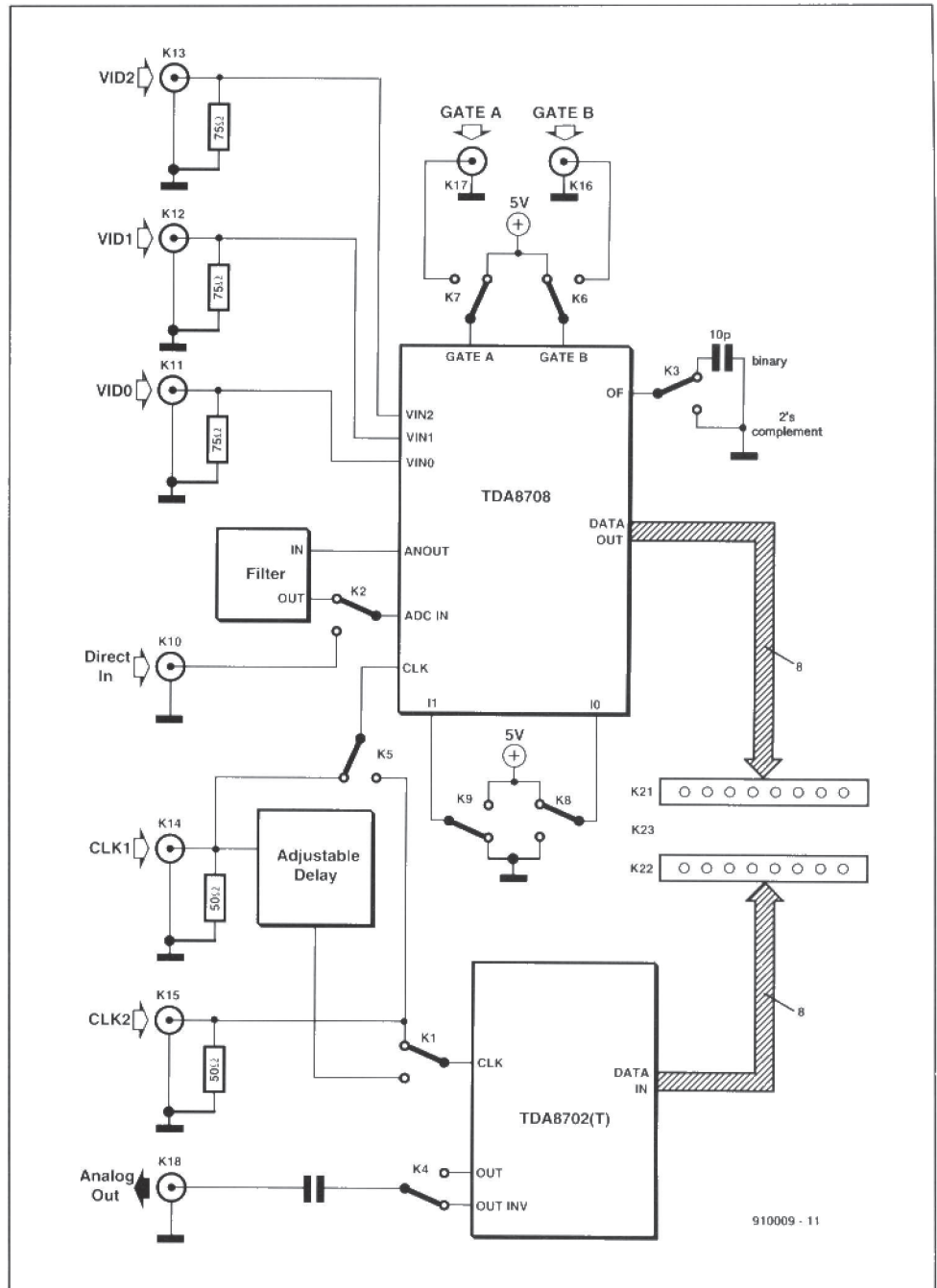


Fig. 8. Block diagram of the video processor card. Most of the switches shown here are wire jumpers to select different modes of operation.

Table 8. Connector overview

Connector	Type	Function	Connector	Type	Function
K1	jumper	Clock 2 / delayed Clock 1	K13	BNC socket	ADC input 2
K2	jumper	Video input / direct input	K14	BNC socket	Clock input 1
K3	jumper	ADC output: binary or 2's complement	K15	BNC socket	Clock input 2
K4	jumper	DAC output: true or inverted	K16	BNC socket	Mode gate B
K5	jumper	Clock 1 / Clock 2	K17	BNC socket	Mode gate A
K6	jumper	Gate B active / disabled (+5 V)	K18	BNC socket	DAC analogue output
K7	jumper	Gate A active / disabled (+5 V)	K19	PCB pin	Clock delay
K8	jumper	Video input selection: Bit 0=H / Bit 0=L	K20	PCB header	Supply voltages
K9	jumper	Video input selection: Bit 1=L / Bit 0=H	K21	PCB header	ADC output
K10	BNC socket	ADC direct input	K22	PCB header	DAC input
K11	BNC socket	ADC input 0	K23	32-way DIN	combined ADC output and DAC input
K12	BNC socket	ADC input 1			

video inputs and the digital control inputs. The analogue output signal of the DAC is available on socket K18. The board is linked to a computer or microprocessor system via connectors K21 and K22, or K23. All digital inputs and outputs of the board are TTL compatible.

The development board is connected to analogue and digital 5-V power supplies via K20. Two separate power supplies are required to ensure the best possible decoupling of the analogue and digital sections.

The 'adjustable delay' block is formed by an integrated circuit that has not been discussed last month. This IC, a Type 1505-5B from Data Delay Devices, contains a stepped delay line. The signal applied to the CLK1 input of the board, K14, can be delayed in steps of 1 ns to a maximum of 5 ns. The delay line has a d.c. resistance of 0.7 Ω and an impedance of about 100 Ω .

Finally, the resistors shown in the block diagram ensure that video sources are terminated in 75 Ω , and the clock inputs in 50 Ω .

The development circuit

The circuit diagram of the video A-D/D-A card is given in Fig. 10. As discussed last month, the TDA8708 stores the current analogue value at the first leading edge of the clock signal, after the 1.5-V threshold is exceeded. You will also recall that the digital equivalent of the analogue value appears at the output after a delay, T_d , of 8 to 20 ns. At the next trailing edge of the clock signal, the DAC copies the digital information, and supplies the corresponding analogue value after the conversion delay, t_d , of 3 ns. Hence, the video input signal is subject to a total delay, T_v , of

$$T_v = T_d + \frac{1}{2}f + t_d$$

At relatively high clock frequencies, say, 30 MHz, it may happen that the minimum required delay time between the A-to-D and D-to-A conversions is not available. The DAC requires that the input data remain stable for at least 0.3 ns. Since the time between the leading and the trailing edge is only 17 ns for a 30-MHz clock signal, it is readily seen that the DAC may have trouble loading stable data when the required delay, T_d , is yet to be subtracted. This potential problem is eliminated by the previously mentioned delay line, IC3, which delays the trailing edge of the clock 1 to 6 ns, depending on the selected 'tap' (jumper K19). This compensation ensures the correct operation of the conversion processes when relatively high clock speeds are used. The diagram in Fig. 9 shows the combined timing of the ADC and the DAC, along with the data setup times and associated delays.

Construction

In view of the speed of the signals involved, the video A-D/D-A circuit is best built on a printed-circuit board of the design shown in Fig. 11. The board is double-sided, but not

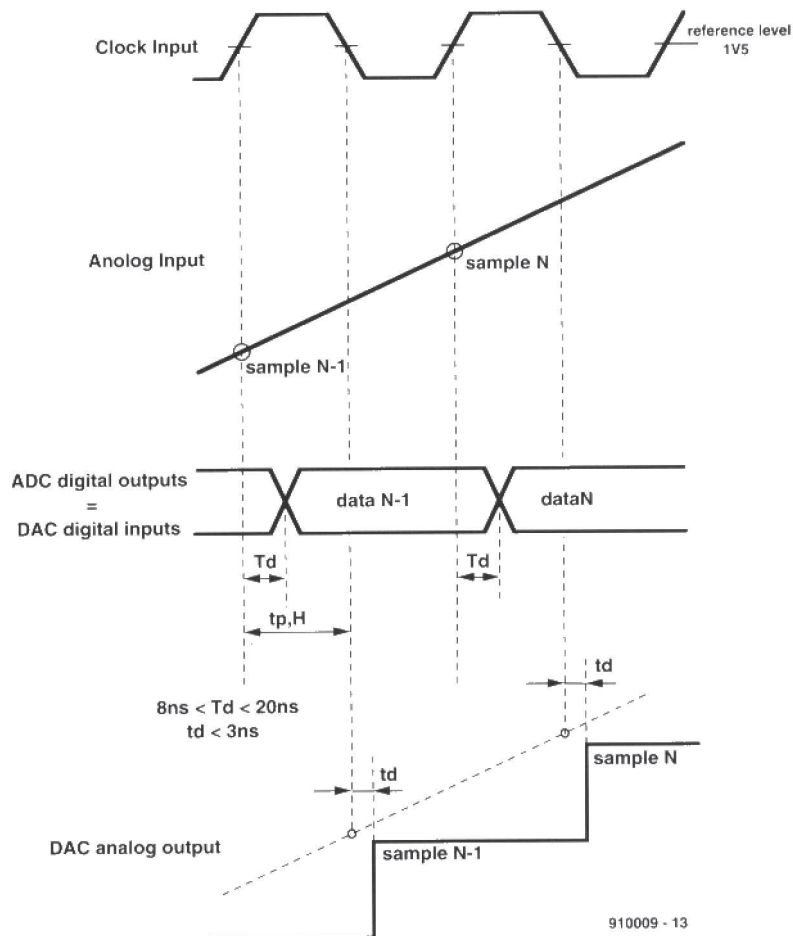
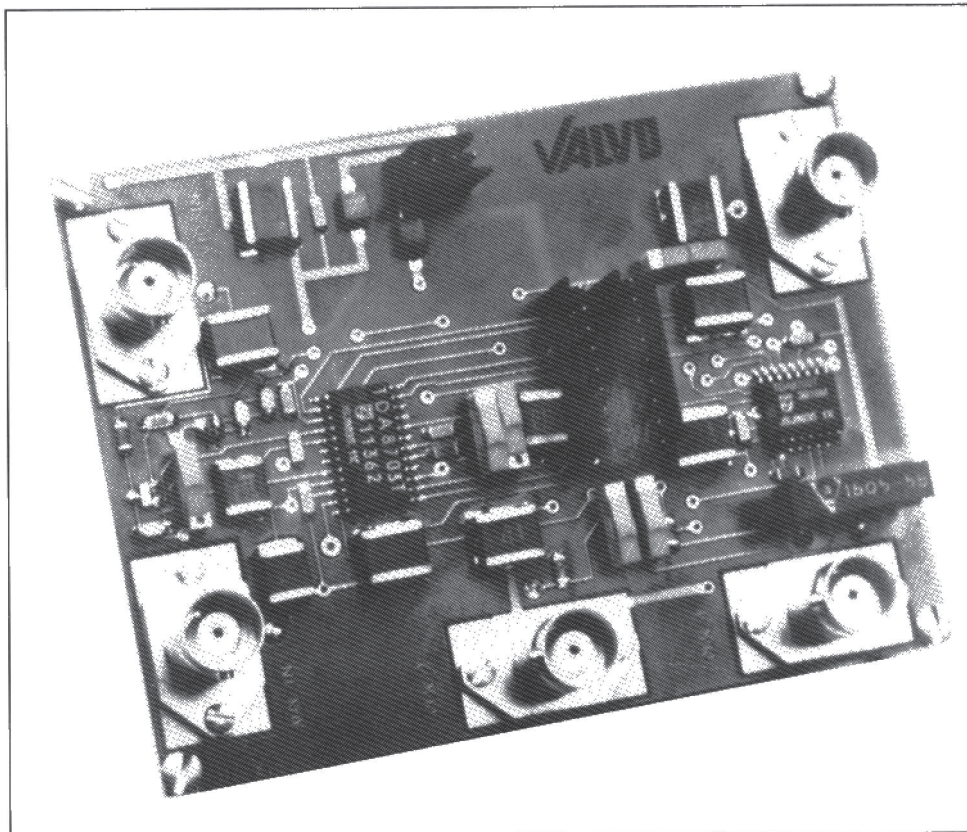


Fig. 9. Overview of conversion timing and data setup times for the ADC and the DAC.

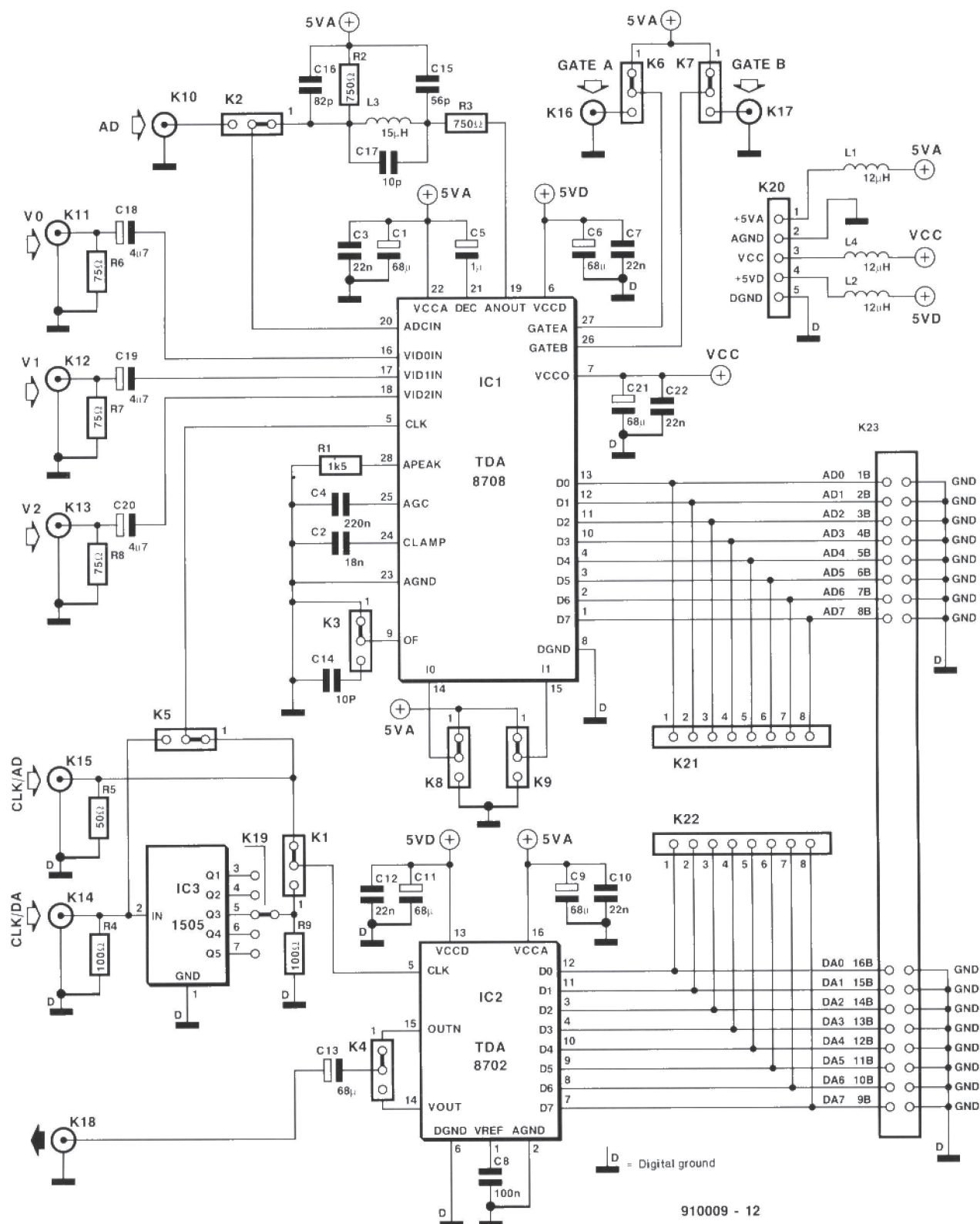


Fig. 10. Circuit diagram of the ADC/DAC converter card. You have the digitized video signal available at a resolution of 8 bits between connectors K21 and K22. A separate connector, K23, allows the card to be connected to a computer bus.

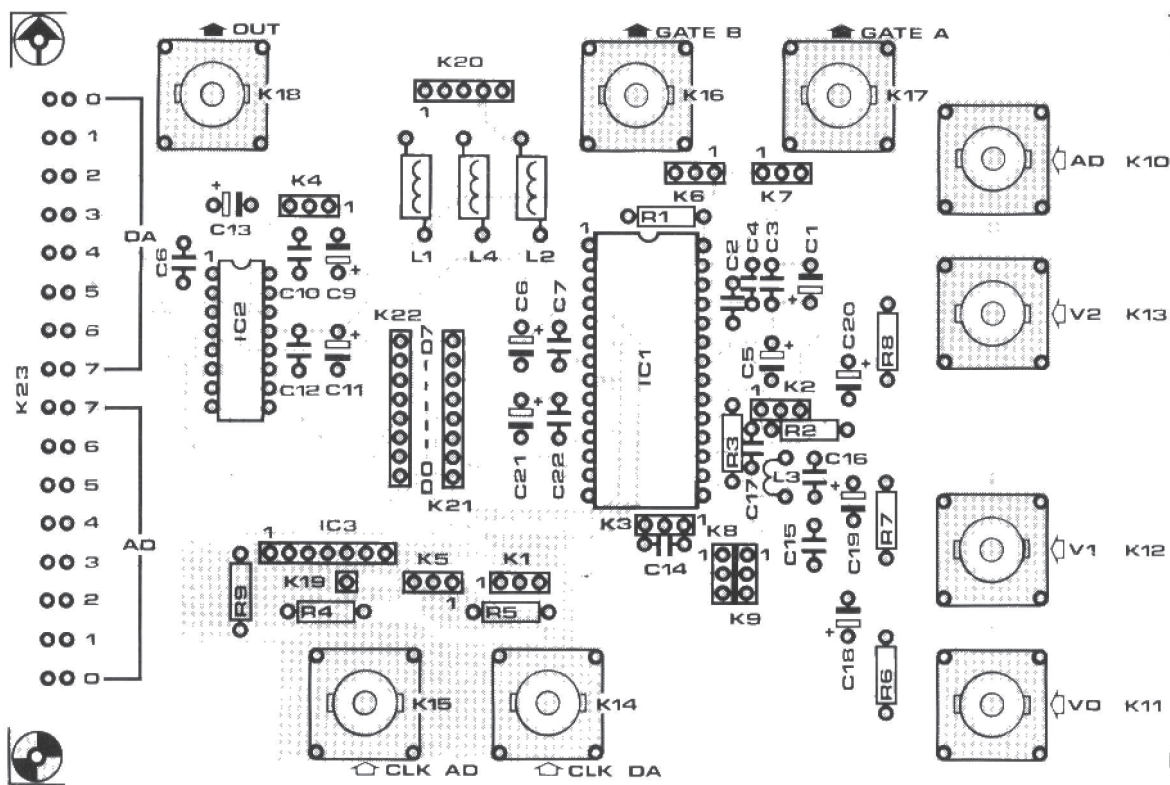


Fig. 11a. Component mounting plan of the double-sided printed circuit board. Note that the board is designed for PCB-mount BNC sockets.

through-plated. Its design allows BNC sockets to be fitted without coaxial cables, which reduces parasitic capacitance to a minimum.

Most of the PCB headers and jumper blocks on the board can be made from single-row and double-row pin headers, which are available in strips of 36 and 72 pins with a spacing of 0.1 inch. Headers K21 and K22, for instance, are 8-pin pieces cut from a larger strip.

Connector K23 is a 32-way angled type to DIN41612. It allows the digital data inputs of the DAC, and the digital outputs of the ADC, to be connected to a microprocessor system bus. For a straight link between the ADC and the DAC, interconnect the corresponding pins on K21 and K22. Finally, note that although an SMA (surface-mount assembly) version of the development board is shown in Fig. 11, all components on the board shown in Fig. 10 have standard sizes. ■

COMPONENTS LIST

Resistors:

1	1kΩ	R1
2	750Ω	R2;R3
2	100Ω	R4;R9
4	75Ω	R5 - R8

Capacitors:

6	68μF 6V3	C21
1	18nF	C2
5	22nF	C3;C7;C10; C12;C22
1	220nF	C4
1	1μF 10V	C5
1	100nF	C8
2	10pF	C14;C17
1	56pF	C15
1	82pF	C16
3	4μF7 10V	C18;C19;C20

Inductors:

3	12μH	L1;L2;L4
1	15μH	L3

Miscellaneous:

1	TDA8708	IC1
1	TDA8702	IC2
1	1505-5b *	IC3

Miscellaneous:

9	3-pin PCB header	K1 - K9
9	PCB-mount BNC socket	K10 - K18
1	solder pin	K19
1	5-pin PCB header	K20
2	8-pin PCB header	K21;K22
1	32-way angled connector to DIN41612	K23

0.1-inch jumpers as required

* UK distributor: BFI Ibexsa Electronics • Burnt Ash Road • Quarrywood Estate • Aylesford • Kent ME20 7NA. Tel. (0622 882467), Fax (0622) 882469.

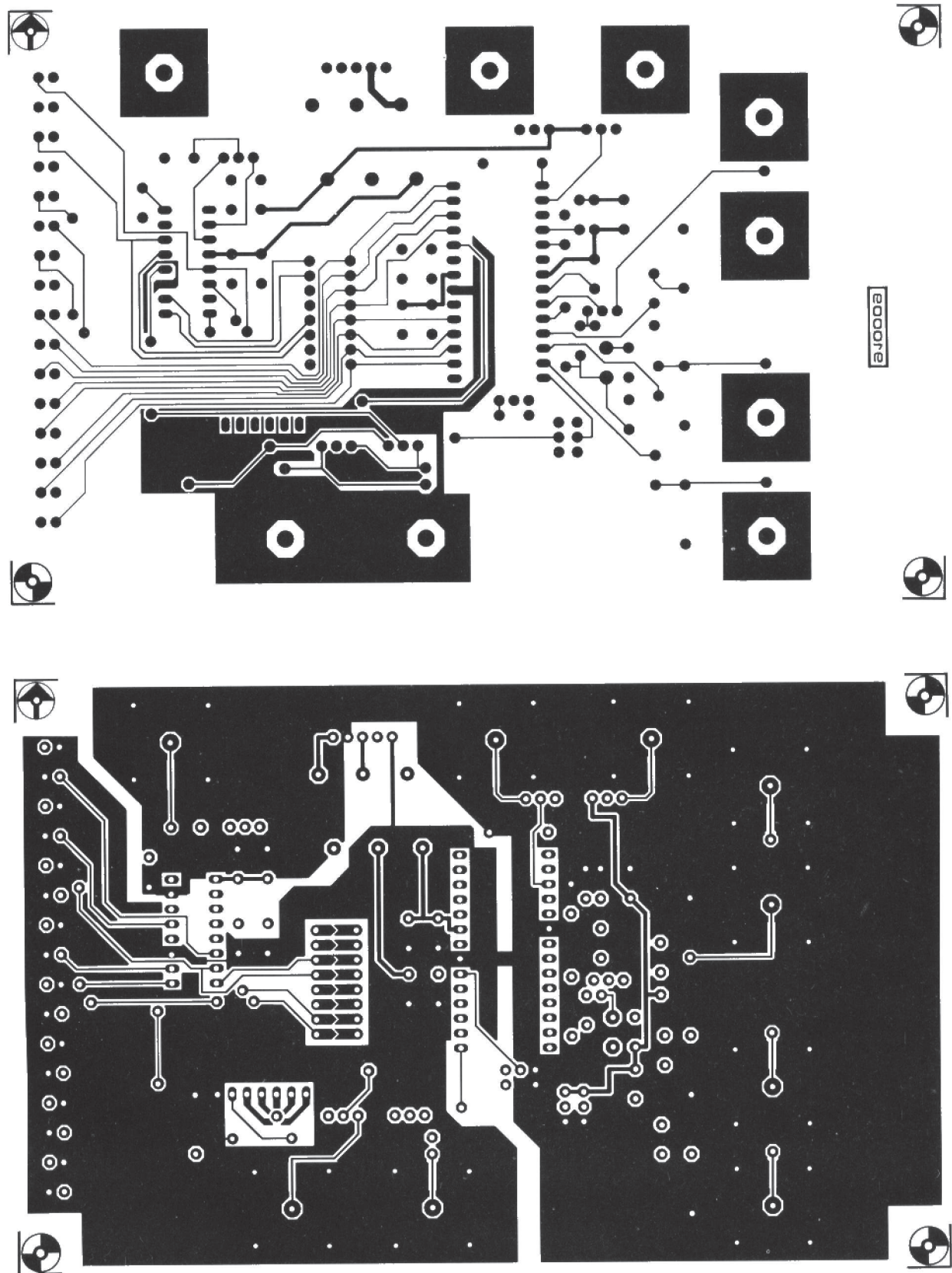


Fig. 11b. Solder side (above) and component side (below) of the PCB for the video ADC/DAC card.